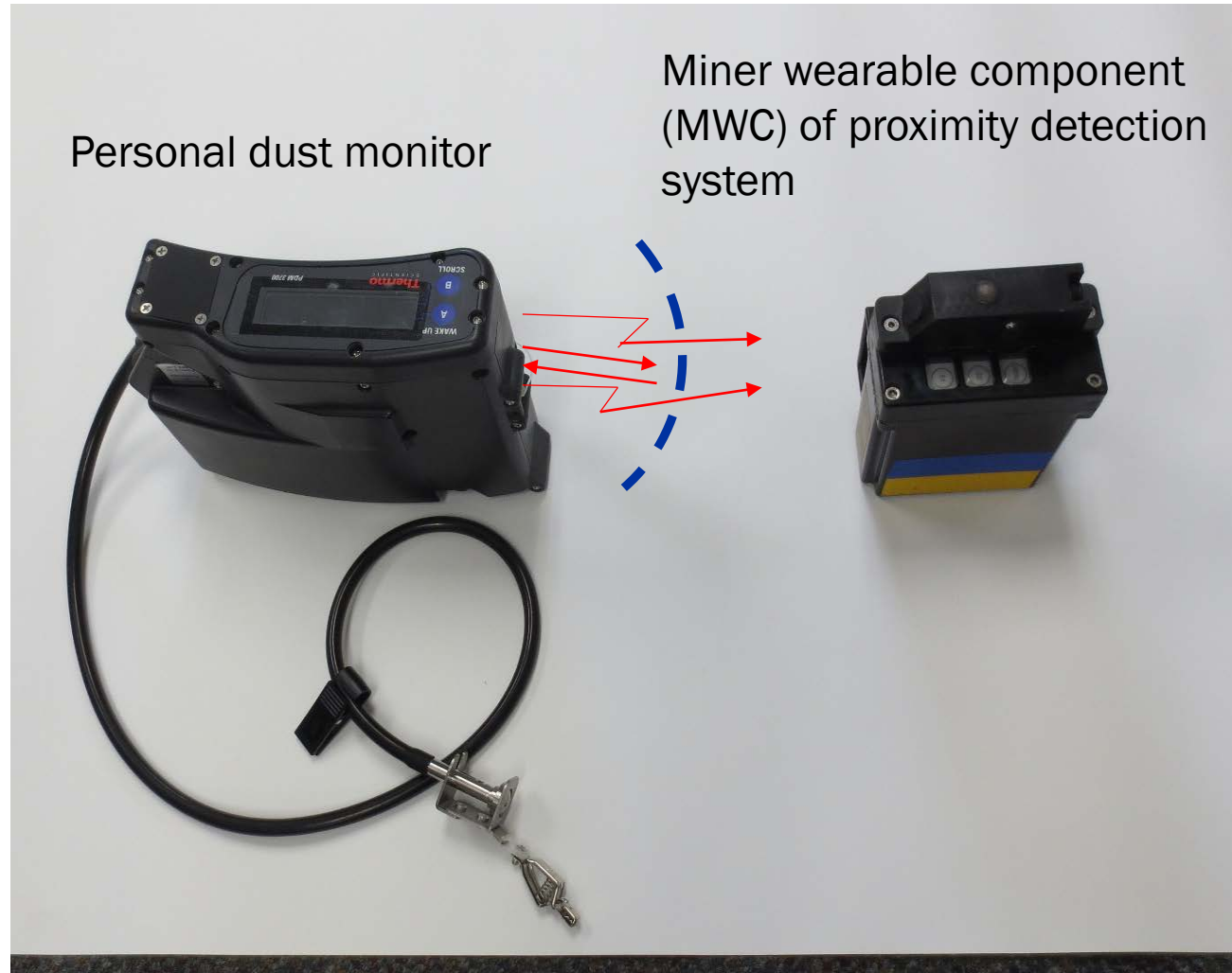
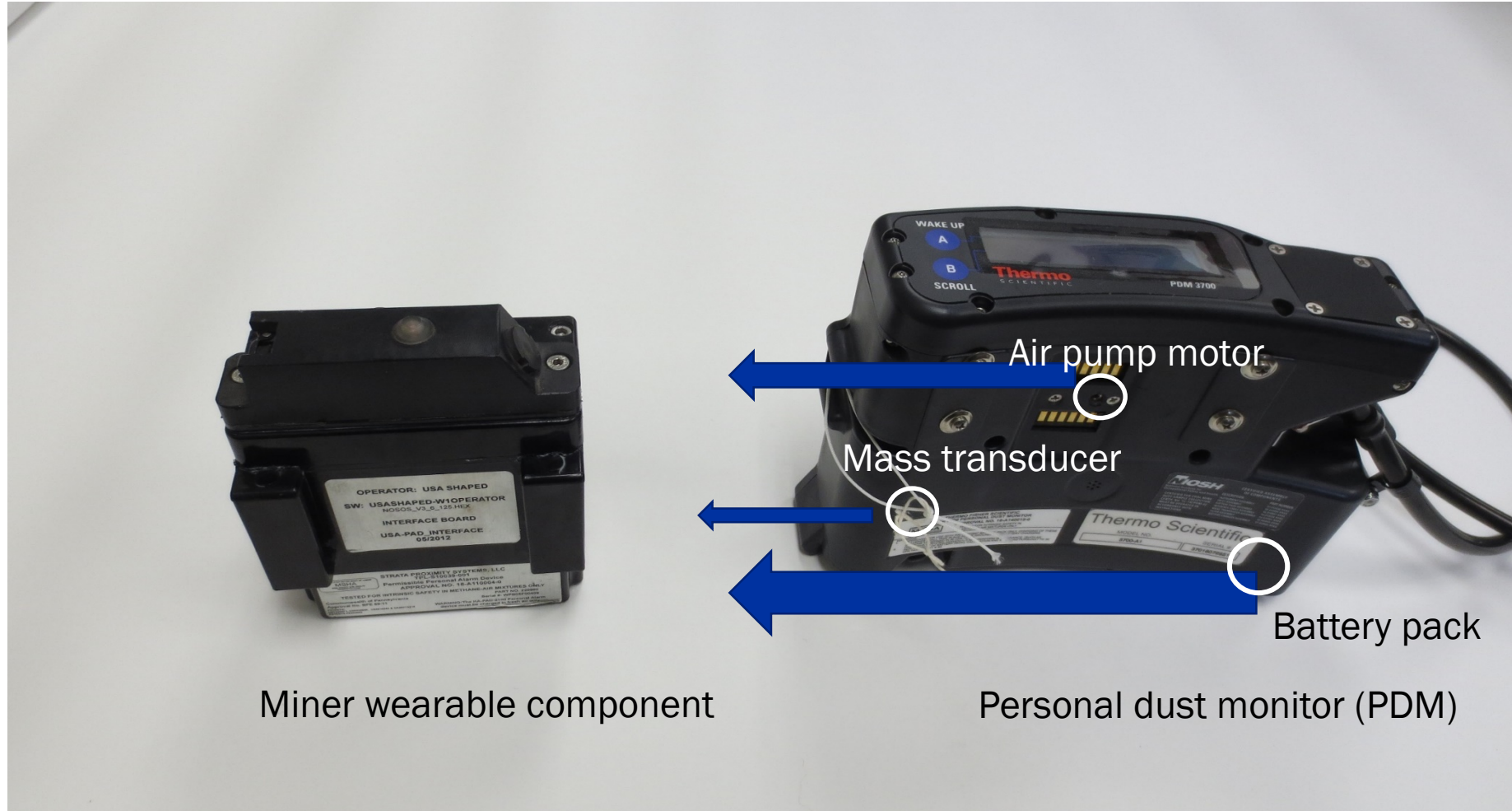


Development of EMI mitigation strategies for internal components of the personal dust monitor (PDM)



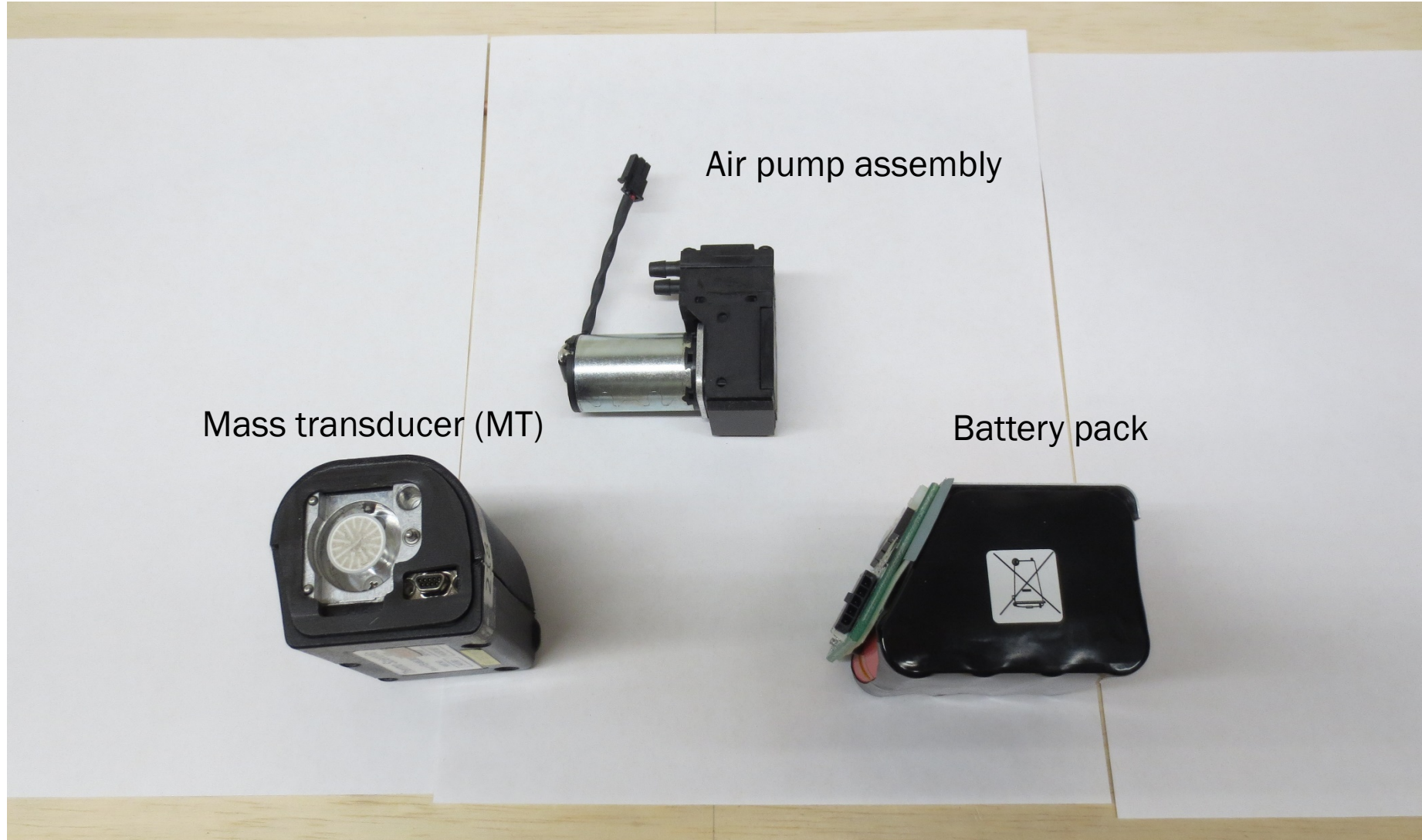
Strong emission areas of personal dust monitor



Miner wearable component

Personal dust monitor (PDM)

Three internal components of PDM

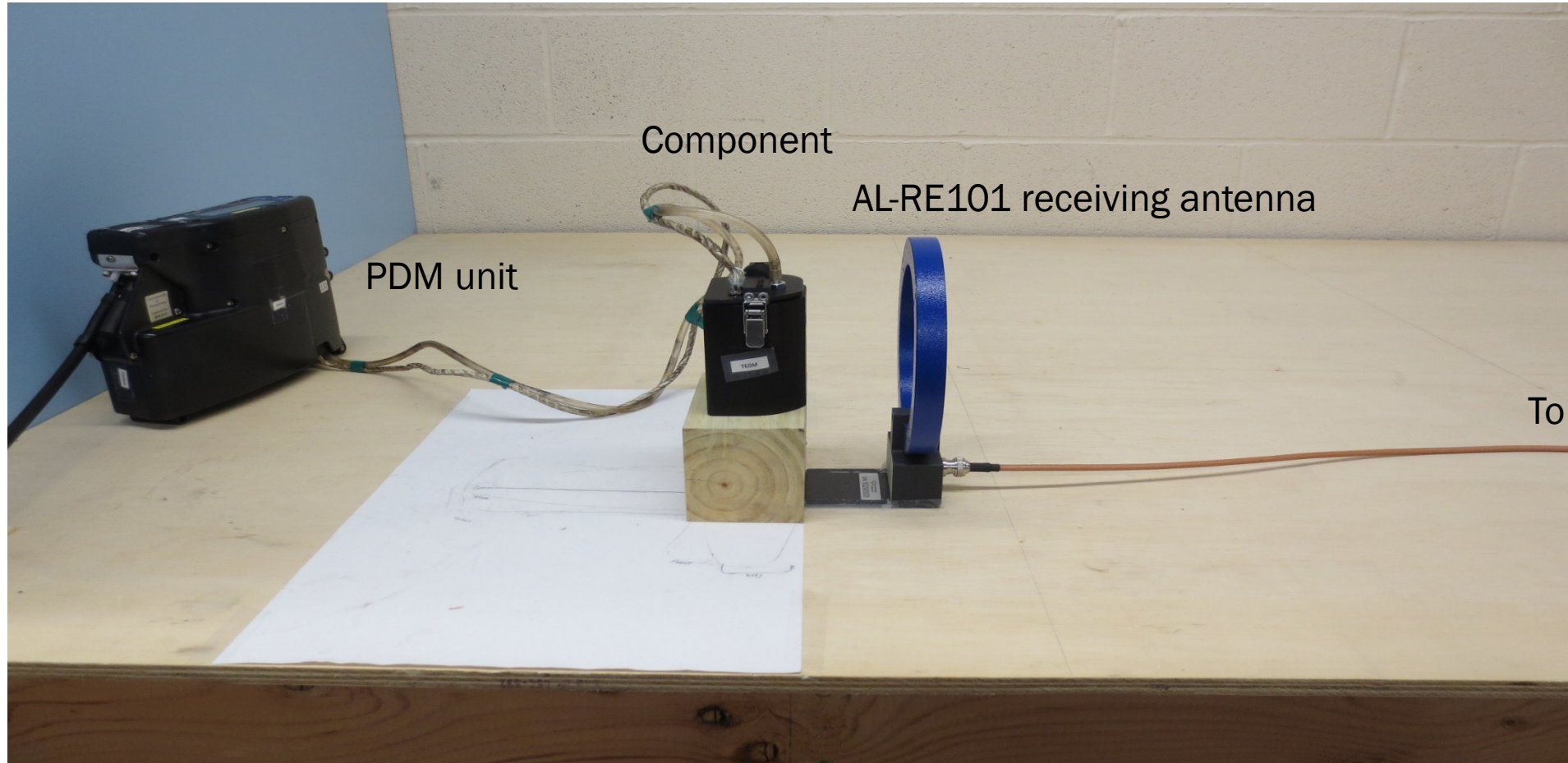


Shielding materials

- Aluminum foils in thicknesses of 0.001” and 0.002”
- Copper foil of thickness of 0.00064”
- Copper mesh in 0.0045” wire diameter and 0.0055” opening
- Silver and graphene epoxy
- Graphene sheet of thickness of 0.01”
- Stainless steel mesh in 0.0079” wire diameter and 0.0049” opening



Mil-STD-461F, Naval radiated emission RE101 test procedures are used



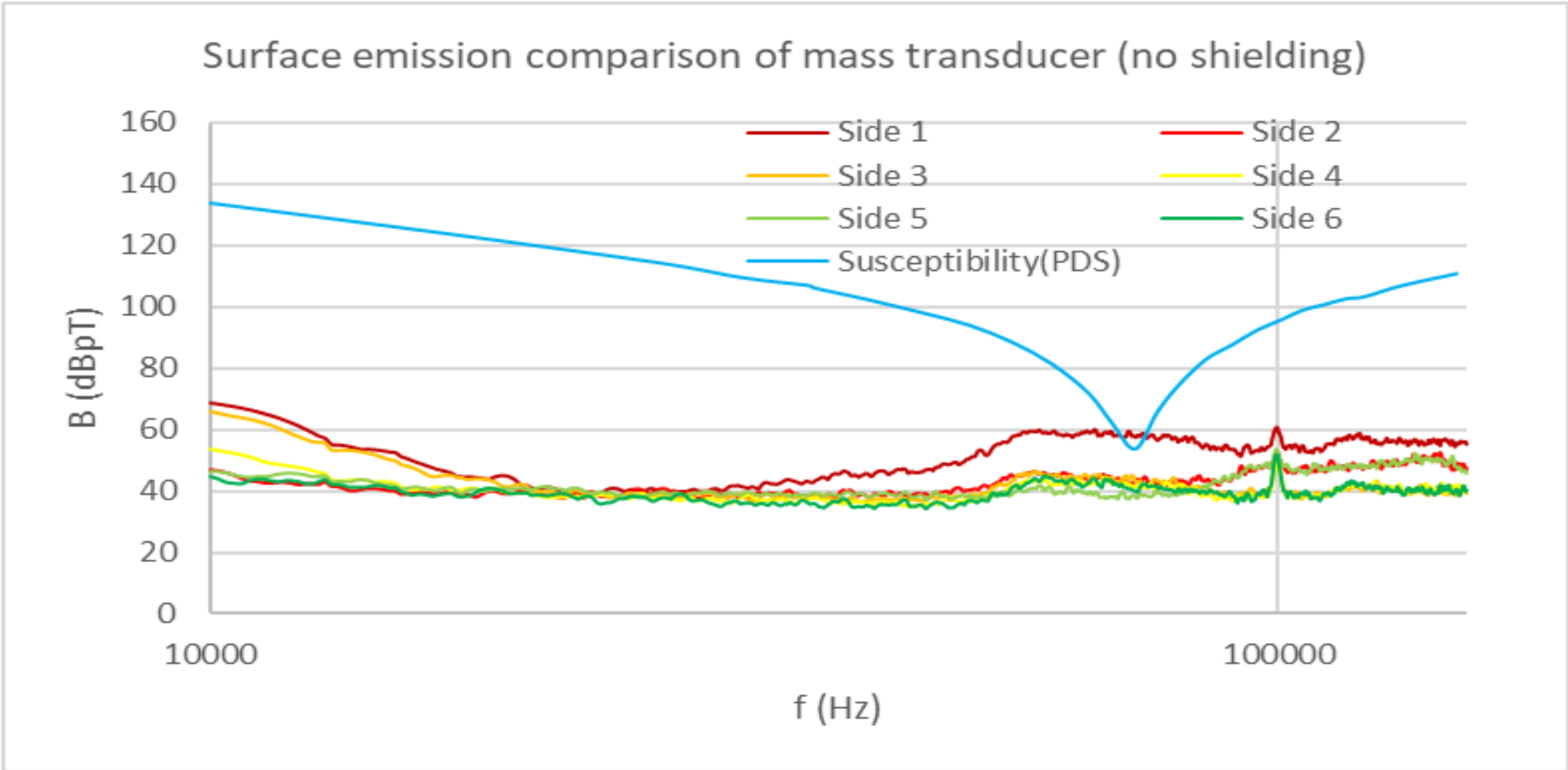
PDM unit

Component

AL-RE101 receiving antenna

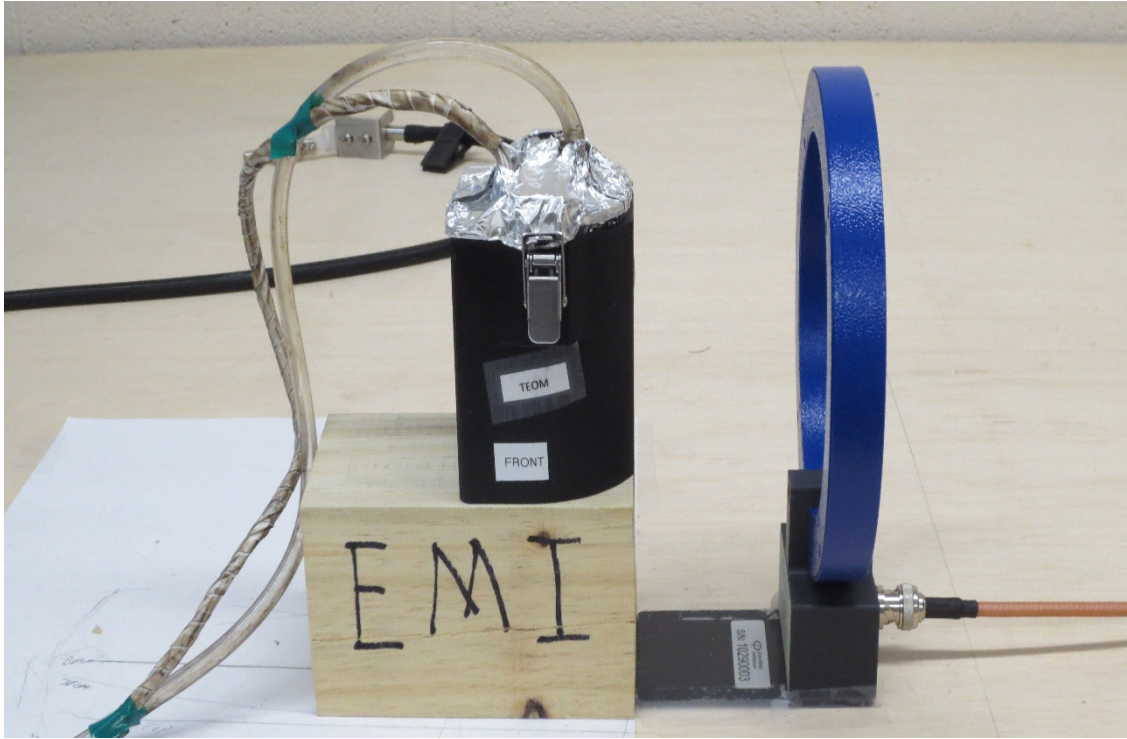
To Signal Analyzer

Emission measurements of six sides of MT without shielding



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MT shielded with enclosures made of aluminum and copper foils

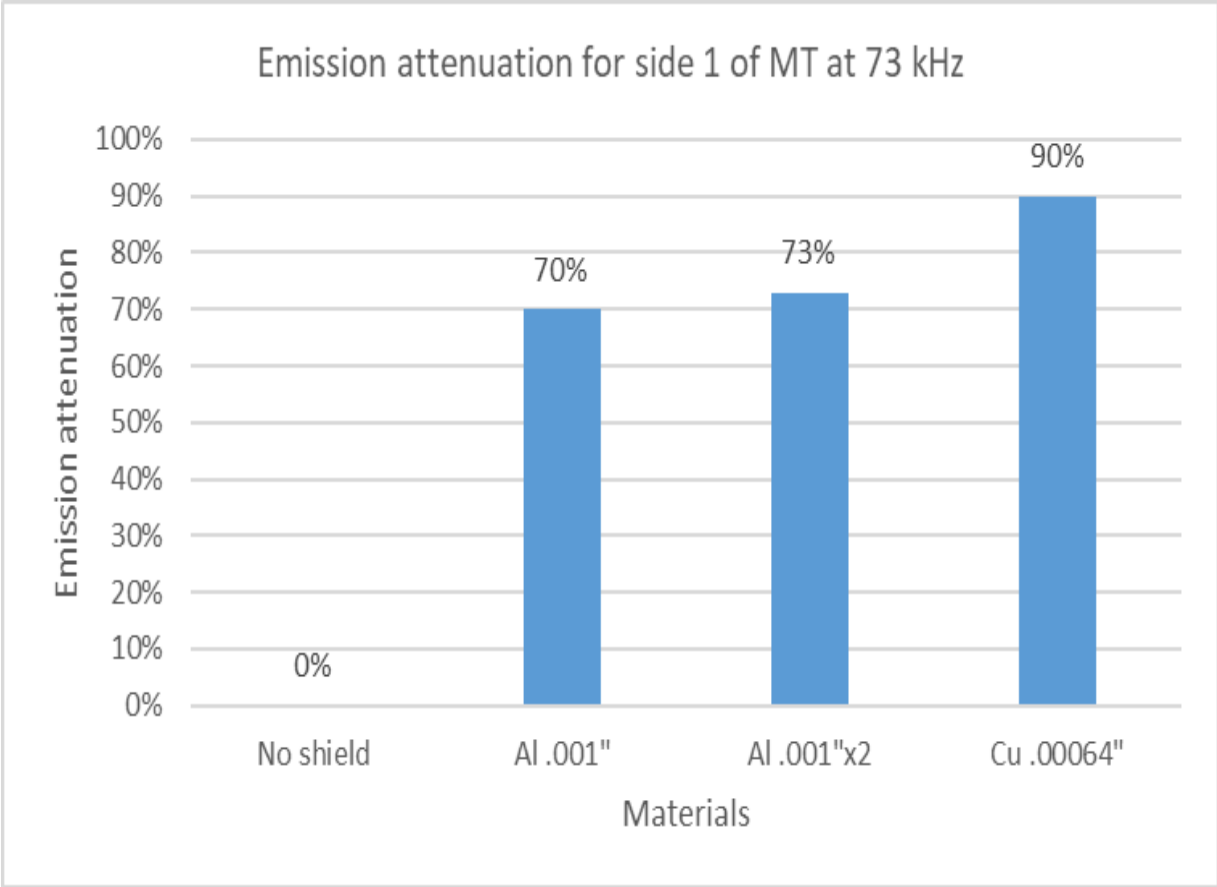
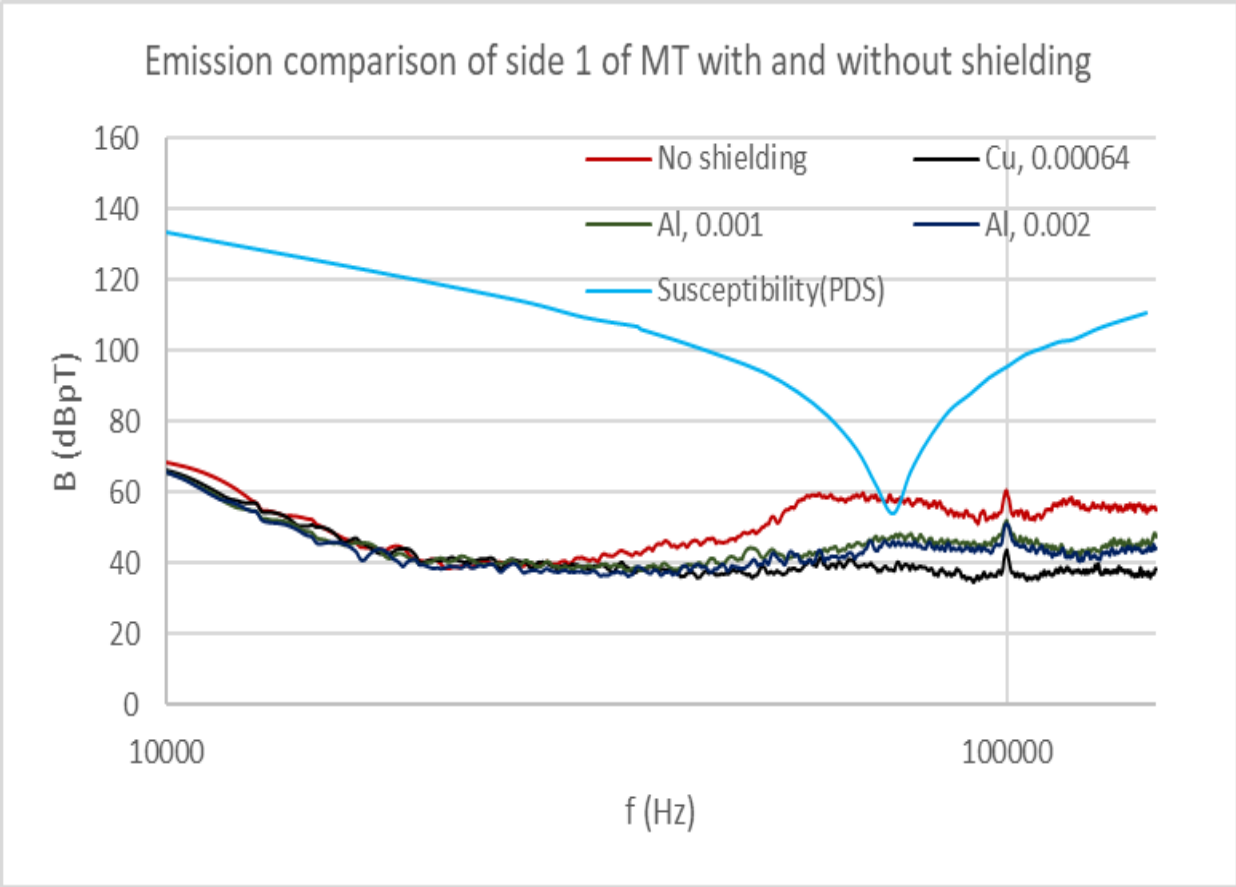


Aluminum foil (0.001") shielding



Copper foil (0.00064") shielding

Emission measurements of MT with and without shielding enclosures

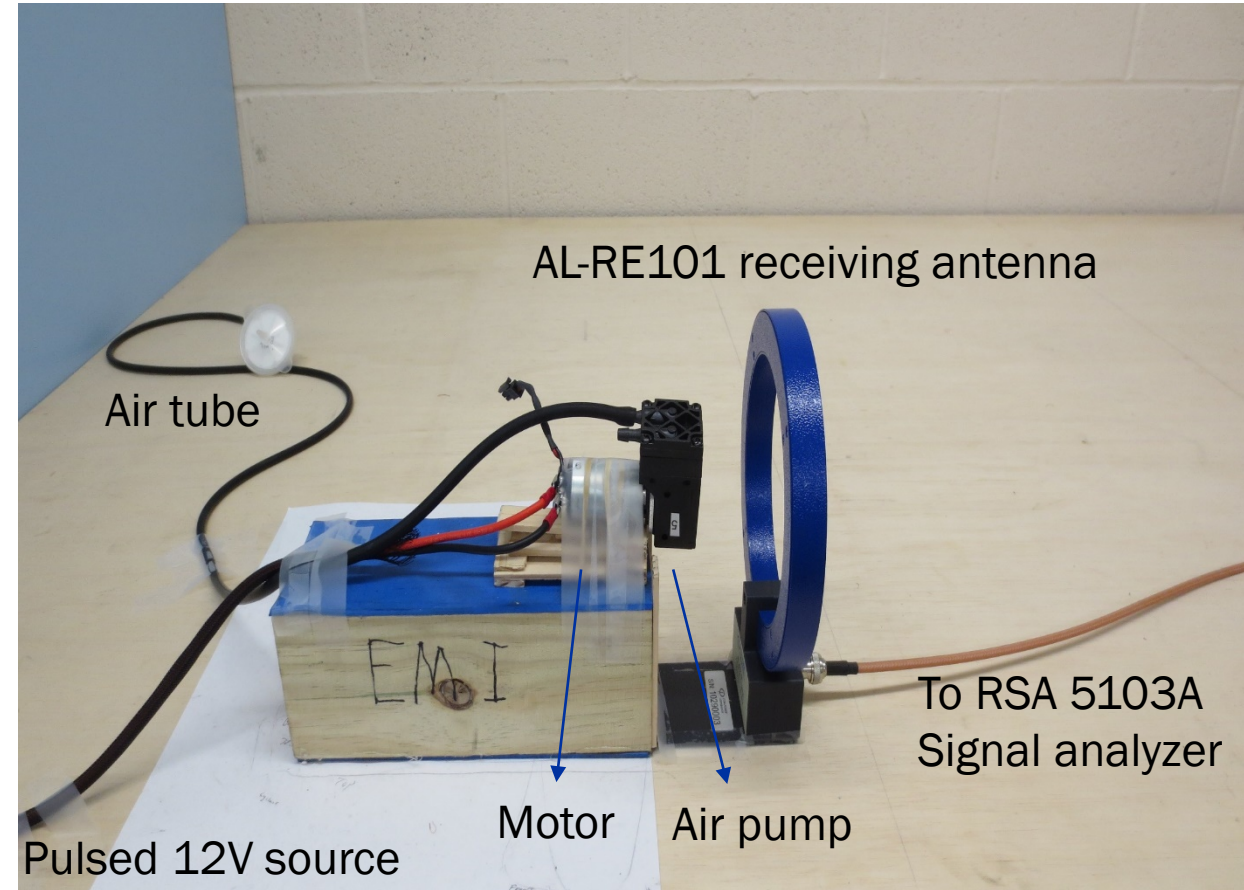
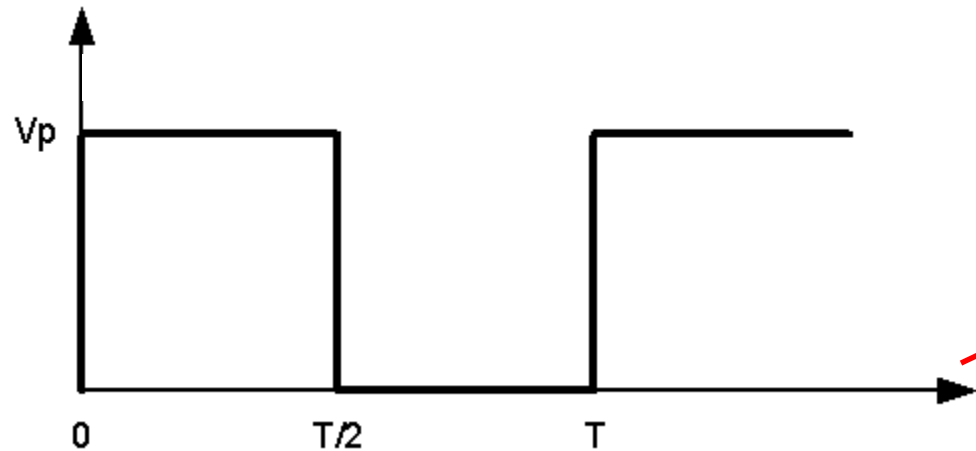


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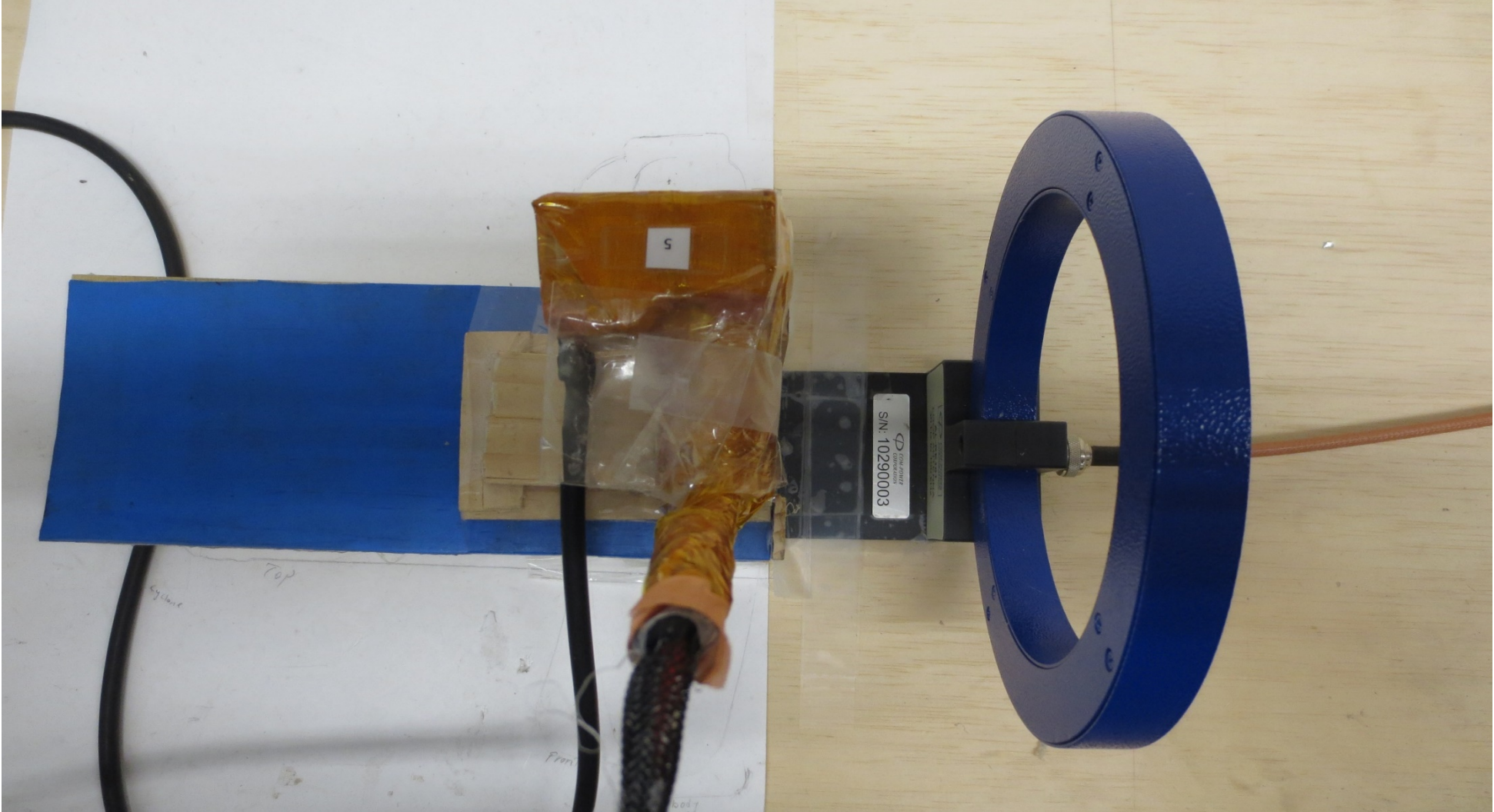
Setup for emission measurements of air-pump motor of PDM

12VDC
10 Hz
20 Hz
30 Hz
40 Hz
50 Hz

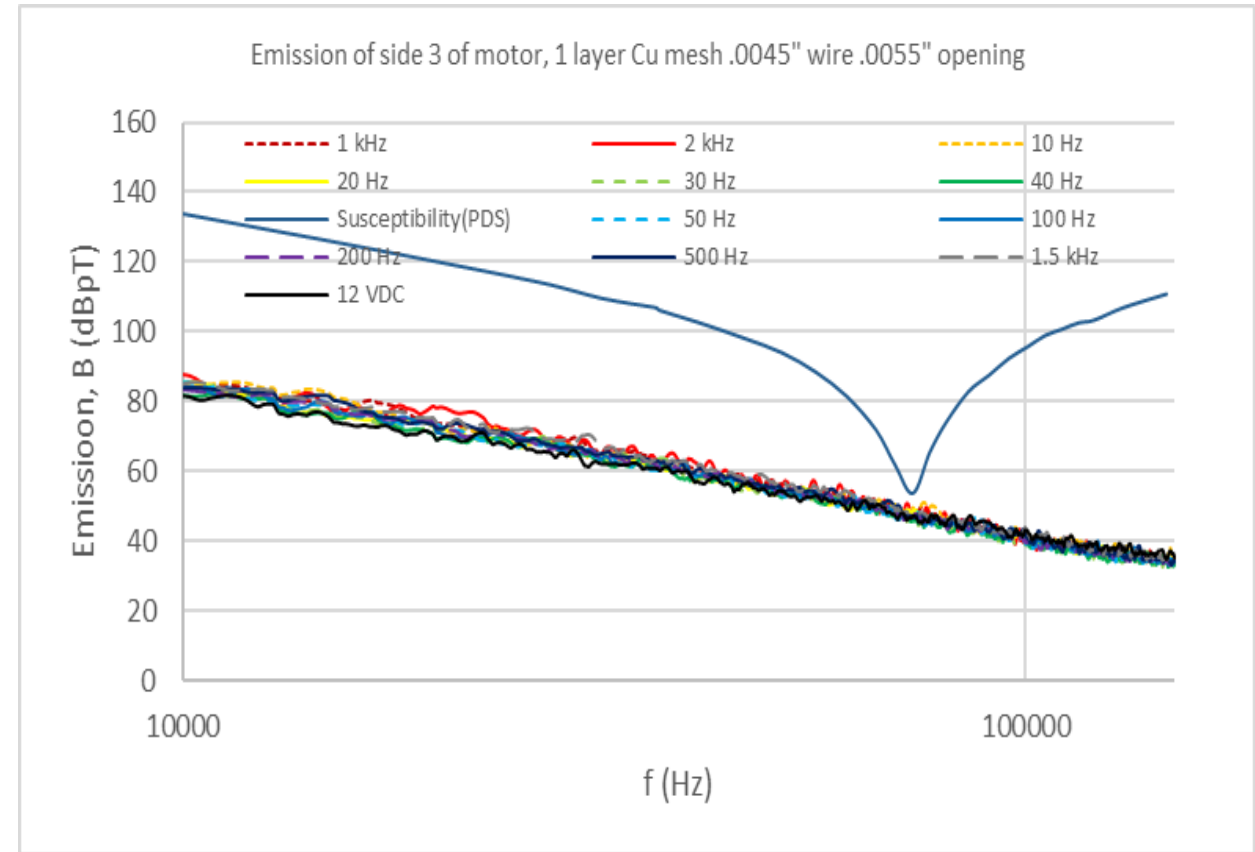
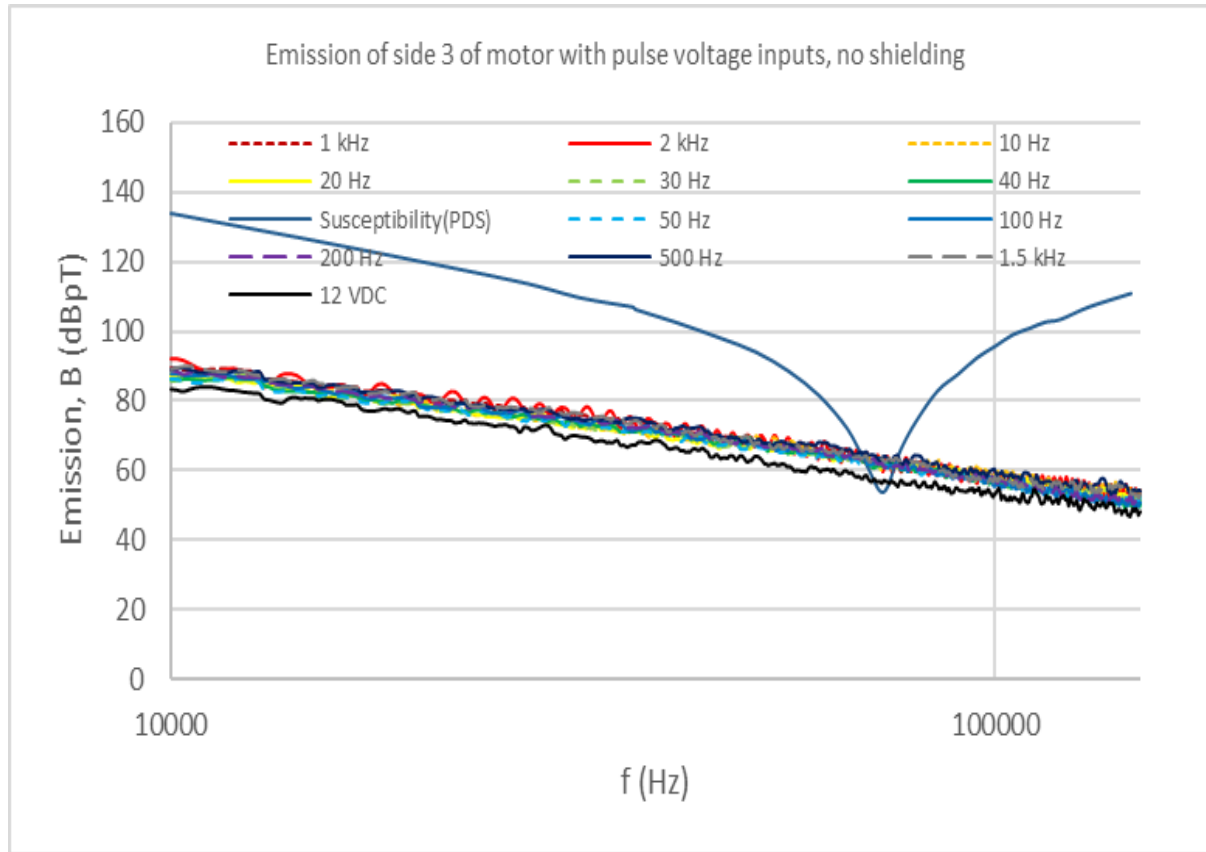
100 Hz
200 Hz
500 Hz
1 kHz
1.5 kHz
2 kHz



Example of motor shield with an enclosure (copper mesh)

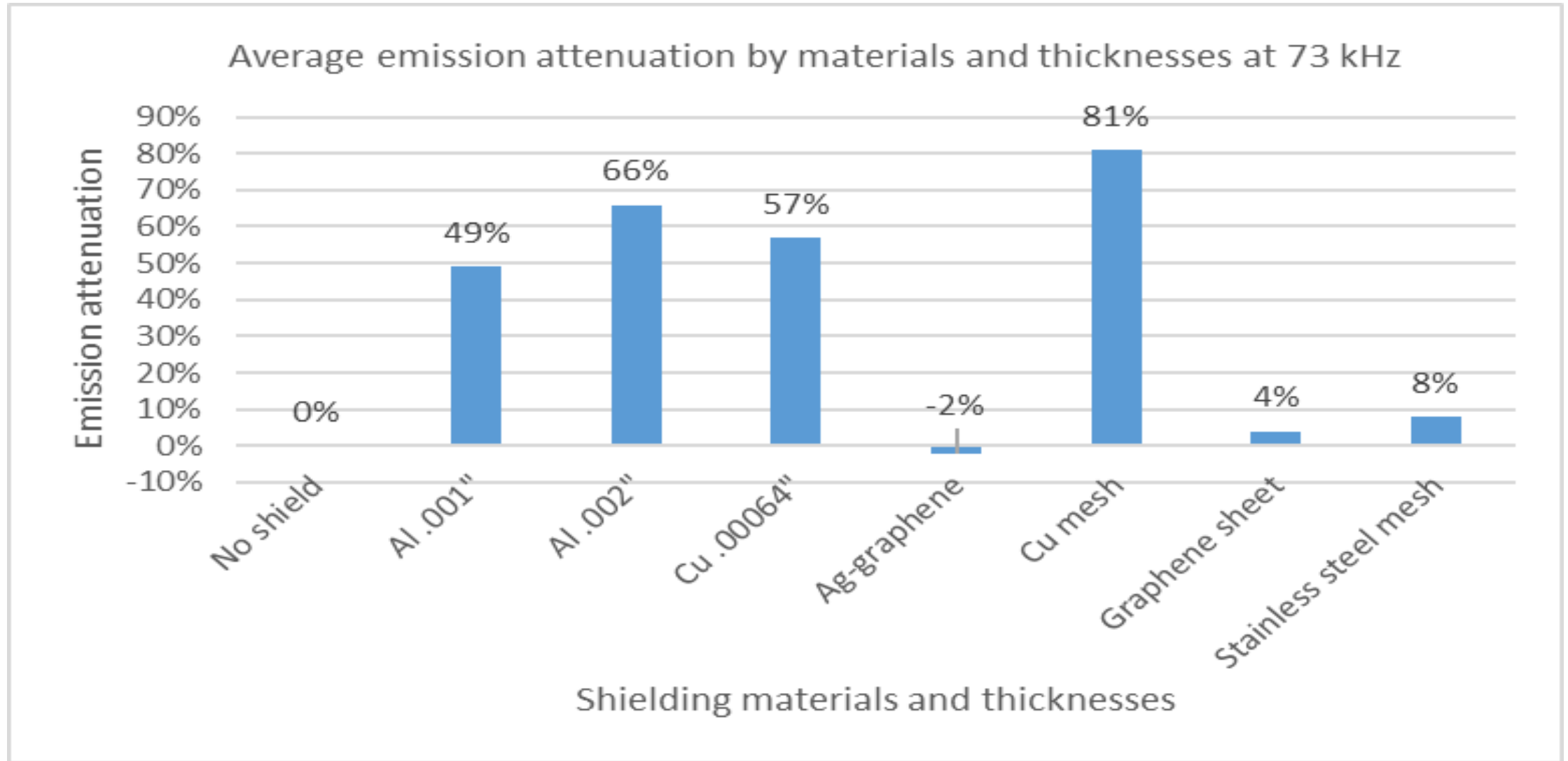


Sample of emission measurements of air pump motor



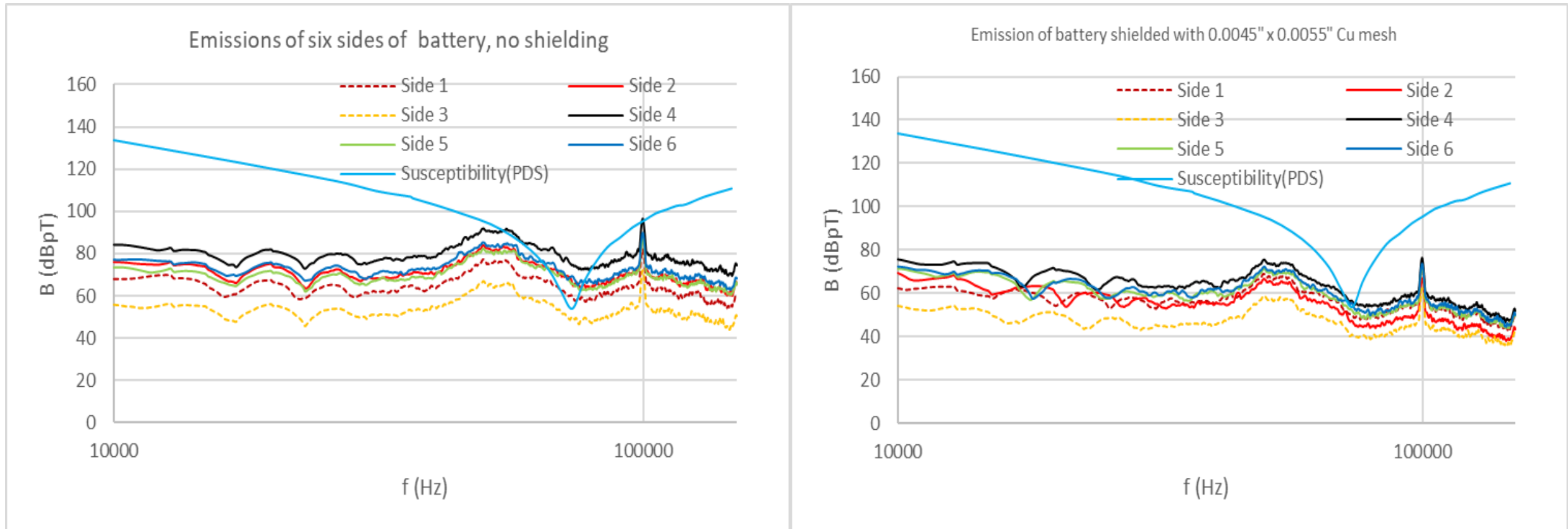
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Comparison of the emission attenuations of motor with different materials



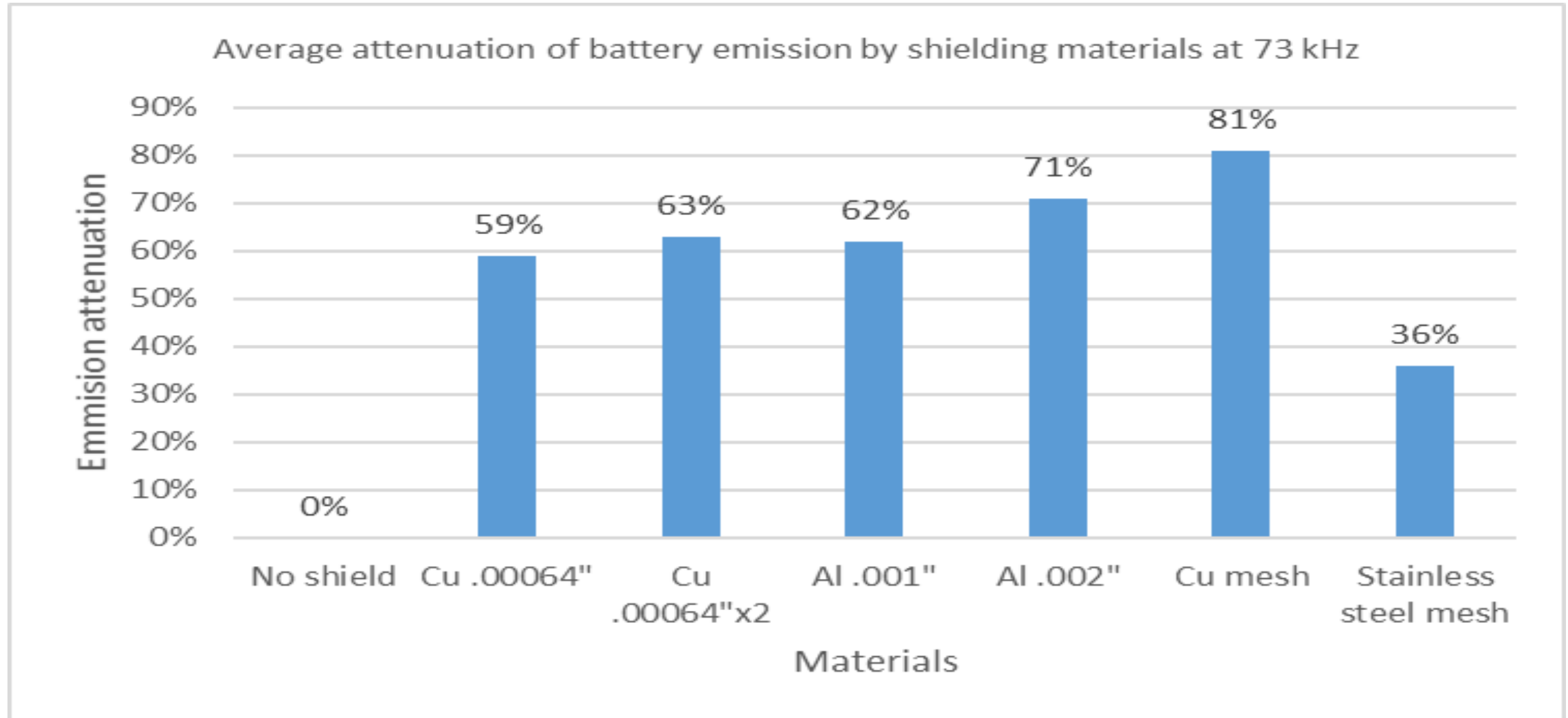
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Emission measurements of six sides of the battery with and without shielding



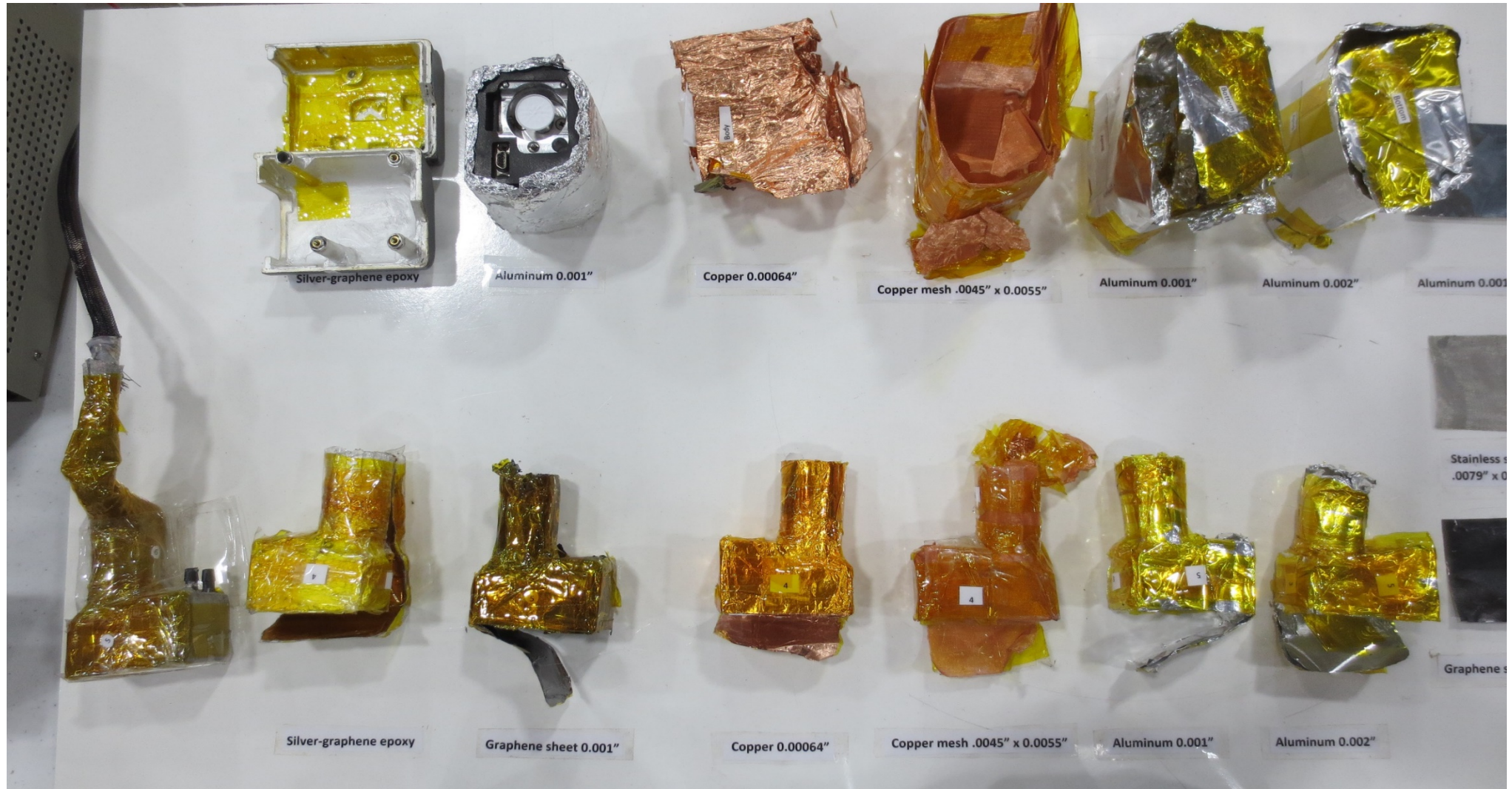
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Attenuations of battery emission by shielding materials



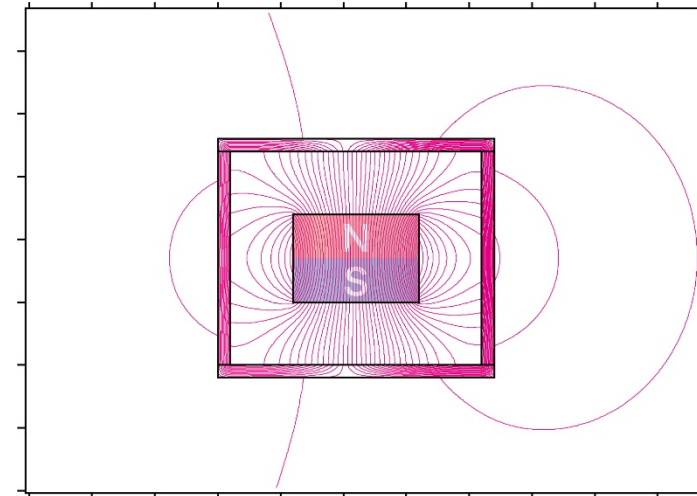
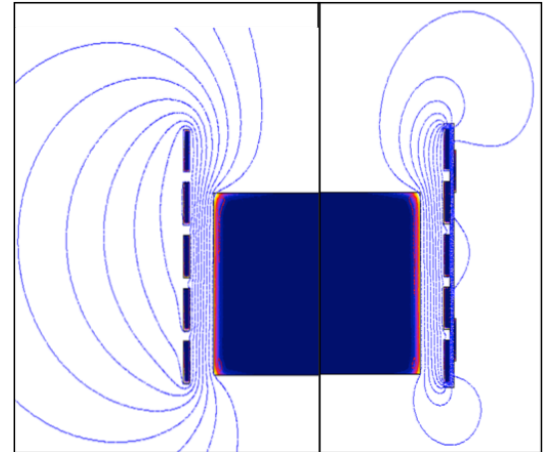
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Shielding enclosures



Conclusions

- Most effective materials
 - Aluminum
 - Copper
- Shielding is most effective when enclosure is small
- Shielding is most effective when enclosure is complete
- Shielding is more effective when enclosure is thicker



Thank you for your attention!

Questions?

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